

Understanding Mercury Fate and Transport from Sources to Deposition

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The ORD's atmospheric mercury research produces information to improve the understanding of mercury transport and fate from the point of emission into the atmosphere to its deposition to terrestrial and aquatic ecosystems. Specifically, this research will produce source emission and atmospheric processes information to improve models that are used to predict atmospheric mercury deposition. These research results will be used to develop scientifically sound policies for mercury risk management. There is currently a significant debate regarding domestic and international environmental mercury policies. Much of this debate centers on the relative contributions of local, regional, and global sources of mercury to domestic and global deposition. Mercury emitted from sources and found in the atmosphere can take one of three forms: elemental gaseous mercury (Hg₀), divalent reactive gaseous mercury (RGM), or particulate phase mercury (Hg(p)). The fate of atmospheric mercury is directly related to the form, or species, emitted. This raises questions, such as: What are the speciation profiles of mercury emissions from various sources? How do atmospheric processes impact transformation and deposition of mercury species?

The ORD's atmospheric mercury research program (MRP) depends upon extensive national and international collaboration with U.S. Environmental Protection Agency (U.S. EPA) regions, program offices, states, national laboratories, and academic institutions. The MRP includes four major elements that are logically organized to address the relevant sciences questions. The first element is the development of the measurement methods. ORD researchers have developed the methodology and instrumentation to make semi-continuous speciated (Hg₀, RGM, and Hg(p)) measurements. In addition, the ORD is developing/evaluating two prototype semi-continuous instruments that measure mercury co-pollutants to provide detailed information about source characteristics. The remaining elements of the MRP address

questions regarding source emission characteristics, atmospheric processes, and source apportionment. High-altitude measurements have been taken via aircraft in Florida and are ongoing at Hawaii, and measurements taken in Alaska, Norway, and Antarctica have provided important information regarding the importance of halide radicals on mercury transformations and fate. These studies have led to atmospheric chamber experiments to quantify mercury reaction rates to improve air quality models. In addition, ORD scientists have collaborated with scientists in Canada, Italy, Germany, and Sweden that are revealing information to improve our understanding of global mercury fate and transport. Finally, the ORD is coupling the use of state-of-the-science mercury measurements with advanced receptor modeling tools to address issues of source apportionment, specifically investigating the relative contributions of local, regional, and global sources to domestic and global deposition.